A method for discriminating recovered beverage containers (10) is provided. The method comprises the steps of selecting any particular color according to the color of the beverage contained in the container (10), measuring the area of the selected color in the container (10), determining whether the measured area of the color is within the fixed range or not, and discriminating the beverage containers (10) in accordance with the determined result.
METHOD FOR DISCRIMINATING RECOVERED CONTAINERS

Technical Field

The present invention relates to a method for discriminating recovered beverage containers. More specifically, the invention is concerned with a method for discriminating beverage containers by optically identifying the beverage residue in the recovered containers.

Background Art

The system for vending beverages such as cola, juice, beer, etc. is roughly classified into two types.

The first type is a system in which used containers are not recovered. In general, this is called as one-way system. According to this system, for instance, beverages are filled in cans at a factory, being transported to an automatic vending machine and consumed by the consumer. The can containing the beverage is not recovered and put away by him.

The second type is a system in which used containers are recovered and which can be called as two-way system. In this system, for instance, beverages are bottled at a factory, being transported to an automatic vending machine and consumed by the consumer. The bottles containing the beverages are recovered for re-use.

The one-way system is generally convenient and has been widely employed as a preferable system. Recently, however, there is a strong opinion demanding that two-way system should be adopted in view of the economical efficiency of reusing bottles or the effective use of an automobile transporting beverages.

An important problem in the two-way system is what kind of inspection and washing should be conducted in order to obtain containers for re-use.

Hitherto, the following procedure has been
adopted, for example, i.e. recovered containers are visually inspected by the human and then the containers considered uncleanable are taken out and only the good containers are wasted.

Such human inspection is an operation which is simple but requires him to be always tensional. Therefore, its mechanization has been demanded.

In contrast, the following inspection has been suggested, i.e. an inspection by which the beverage residue in the recovered container is withdrawn and then the residue is analyzed by means of an analyzer. However, since the inspection using such analyzer takes much time and cost, this is not efficient.

Disclosure of Invention

Thanks to an advanced washing technique, even if various foreign matters have remained in the bottle, these foreign matters do not substantially remain after washing the bottle, thereby permitting its bottle to be used as a beverage container.

However, if tempura oil or the like remains as a foreign matter in the bottle, this involves a problem of adhering to a brush of the washer and causing a trouble in the later washing.

Therefore, the following operation has been suggested, i.e. an operation in which the recovered bottles are discriminated by judging whether they are bottles considered to have been recovered without being truly utilized for other purposes or whether they are bottles considered to have been utilized for other purposes and thereafter, the bottles recovered without being used for other purposes are washed in accordance with an usual washing step, while the bottles judged to have been used for other purposes are washed in accordance with a different washing step. Such washing system is judged to have a good efficiency and to be preferable.
In the case of employing such washing system, it becomes an important problem how the recovered bottles are discriminated by judging whether they are bottles considered to have been recovered without being truly utilized for other purposes or whether they are bottles considered to have been used for other purposes.

On the other hand, in the beverage container having a screwed cap the consumer desires to cap the container after drinking the beverage for the purpose of protecting the mouth of a bottle, etc. Because of this, this type of container recovered to the factory is capped in a high proportion. Usually, some amount of beverage remains in the bottle even after the beverage is poured into a cup or the like. If the bottle is capped after drinking the beverage as above, evaporation of the beverage is inhibited. For instance, 2 cc or more of cola generally remains in the recovered one-liter Coca-Cola bottle.

Even in the case of a container not using a screw cap, the dried beverage matter adheres to the bottom of the container.

On the contrary, where the bottle has been utilized for other purposes, there is no case where the beverage remains at the bottom of the bottle.

Accordingly, the recovered bottles can be discriminated about whether they are bottles considered to have been used for other purposes or not by detecting whether the beverage remains at the bottom of the recovered bottle.

According to the present invention, there is provided a method for discriminating recovered beverage containers which comprises the steps of discriminating any particular color according to the color of beverage contained in the container, measuring the area of the selected color in the container, determining whether the area of the selected color is within the fixed range, and
discriminating the beverage containers in accordance with the determined result.

In the method for discriminating the recovered beverage containers according to the present invention, a specific color is chosen on the basis of the color of the beverage contained in the container. For instance, the color of the beverage itself, the beverage color recognized through the container, the color recognized when the beverage gets dry, etc. are chosen.

The area of the selected color in the container is measured. It is decided whether the measured color area falls into the fixed range or not. If the measured area of the color is within the fixed range, its container is judged not to have been utilized for other purposes. And if the area is outside the fixed range, its container is judged to have been used for other purposes.

The beverage containers are discriminated according to whether the measured color area falls into this scope or not.

Brief Description of Drawings

Figure 1 is a sketch of the discriminator device for working the recovered bottle discrimination method according to one working example of the present invention.

Figures 2-(a) and 2-(b) are a picture on the screen of the monitor TV set indicating an usual image of the bottle having totally no residue and a picture showing only the selected color portion of this bottle, respectively.

Figures 3-(a) and 3-(b) are a picture on the screen of the monitor TV set indicating an usual image of the bottle in which 2 cc of the residue remains and a picture showing only the selected color portion of this bottle, respectively.

Figures 4-(a) and 4-(b) are a picture on the
screen of the monitor TV set indicating an usual image of the bottle in which 20 cc of the residue remains and a picture showing only the selected color portion of this bottle, respectively.

Figures 5-(a) and 5-(b) are a picture on the screen of the monitor TV set indicating an usual image of the bottle in which 800 cc of the residue remains and a picture showing only the selected color portion of this bottle, respectively.

**Best Mode for Carrying Out the Invention**

Next, by referring to the accompanying drawings an explanation will be made about the discriminator device for working the process for discriminating the recovered containers in accordance with the preferable working example of the present invention.

As shown in Figure 1, this discriminator device is provided with a conveyor unit 12 for moving the recovered bottle 10 continuously, a camera unit 14, a color selector 16, an information processor unit 18 and a bottle rejector 20.

The conveyor unit 12 works to move the recovered bottle 10 continuously at a rate of 10 to 400 pcs/min., for example. There is mounted an illuminator unit 22 for illuminating the bottle 10 in the fixed position on the conveyor unit 12.

On the conveyor unit 12 is further installed a bottle sensor 24. Whereby a detection signal is fed to the color selector 16 when the bottle 10 has reached the fixed position.

The camera unit 14 is connected to the color selector 16. Depending on the detection signal from the bottle sensor 24, one picture is taken per bottle, for instance. In the illustrated example the camera unit 14 takes a slant picture of the bottle. Instead, the camera unit can be so arranged as to take a picture of the bottle immediately from the top. By taking such picture
of the bottle immediately from the top, the present invention can be also applied to an opaque container. As the camera unit 14 can be used a solid camera unit which uses a CCD having 250,000 pixels, for instance.

The color selector 16 is further connected to a monitor TV set 26 and an image taken by the camera unit 14 is displayed on the screen of the monitor TV set 26. Moreover, the color selector 16 stores any color selected depending on the color of the beverage, the beverage color observed through the container or the color recognized when the beverage gets dry, etc. beforehand. On the screen of the monitor TV set 26 can be displayed only the selected color portion of the picture taken by the camera unit 14 and sent to the color selector 16. A now available color selector can specify a color with sufficient precision. Where a particular cola color is selected, a liquid having any other color is not displayed. The particular cola color is not substantially present in the taken picture. The picture displayed on the screen of the monitor TV set 26 is the same as that in the case of an empty bottle.

In addition, the color selector 16 counts the number of pixels on the picture taken by the camera unit 14 detecting the above selected color and emits the counted number as an output. This pixel number corresponds to the area of the selected color in the taken picture.

An information processor unit 18 stores a desired range of the pixel number inputted by a key board, an inout means, e.g. a range of the pixel number of 60 to 60,000. Being 60 or less in the pixel number means that only the slight amount of beverage remains at the bottom of the container or absolutely no beverage residue is found at the container bottom. Whereby its container is judged to have been utilized for other purposes. Being 100,000 or more in the pixel number
indicates that the selected color has been detected in
the pixel number greater than that detected where the
container is filled with the beverage. This is judged
such that any trouble has occurred. These ranges can be
selected according to various conditions. For instance,
they can be chosen variously by the kind of the used
camera unit, position relation between the camera unit
and the bottle, shape and transparency of the bottle.

The information processor unit 18 is connected
to the color selector 16 and this unit 18 receives the
pixel number detecting the selected color in the taken
picture from an output of the color selector 16, judging
whether this pixel number falls into the stored desirable
range of the pixel number and emitting its result as an
output.

The information processor unit 18 is further
connected to a display monitor 30 and a printer 32,
displaying data on the above pixel number in a plurality
of pictures of a series of the bottles 10 on these unit
and printer.

The bottle rejector 20 is connected to the
information processor unit 18 and works to guide the
bottle 10 to the first course 34 or the second course 36.

Thus, the bottle 10 guided to the first course
34 means being a bottle in which the pixel number within
the desired range has the selected color in these pic-
tures. This indicates that the residue having any fixed
color is present in this bottle 10 in a predetermined
amount. While, the bottle 10 guided to the second course
36 means being a bottle in which the residue with any
fixed color is not present in a predetermined amount.

Next, by referring to Figures 2 to 5 an ex-
planation will be made of one liter size Coca-Cola
bottles.

Figure 2-(a) is a picture on the screen of the
monitor TV set 26 indicating an usual image of the bottle
in which absolutely no residue is found. Figure 2-(b) is a picture showing only the selected color portion of this bottle. In this case, the selected color portion is not found at all and the pixel number detecting the selected color is zero.

Figure 3-(a) is a picture on the screen of the monitor TV set 26 indicating an usual image of the bottle in which an usual quantity of the residue, e.g. 2 cc remains. Figure 3-(b) is a picture showing only the portion of the selected color of this bottle. In this case, the pixel number detecting the selected color is 80-100, for example.

Figure 4-(a) is a picture on the screen of the monitor TV set 26 indicating an usual image of the bottle in which the quantity of the residue is relatively large, e.g. 20 cc remains. Figure 4-(b) is a picture showing only the portion of the selected color of this bottle. In this case, the pixel number detecting the selected color is 8,000-10,000, for example.

Figure 5-(a) is a picture on the screen of the monitor TV set 26 indicating an usual image of the bottle in which the beverage is hardly drunken and therefore, a large amount of the residue remains, for example, 800 cc of the residue remains. In this case, the pixel number detecting the selected color is 40,000-50,000, for example.

As shown in the above example, where the desired range of the pixel number is stored as being 60-10,000, the bottle shown in Figure 2 is guided to the second course 36 by means of the bottle rejector 20, while the bottles shown in Figures 2 to 5 are guided to the first course 34.

Thus, it is possible to discriminate the bottles recovered without being used for other purposes from those utilized for other purposes.

Further, in the above example, an explanation
was made by giving a container using a screw cap as one example. But the present invention can be also applied to a container not using a screw cap.

In this case, as the container is not capped, the beverage remaining in the container has dried up, and the dry beverage matter adheres to the bottom of the recovered container.

By measuring so the color and the area at the bottom of the container to which the dry beverage matter adheres it is possible to discriminate the bottles recovered without being used for other purposes from those utilized for other purposes.

Or the above selection is possible by adding a small amount of water or the like to the bottle after recovered thereby to reproduce the beverage and then measuring the color and the area of the reproduced beverage as in the above manner.

Further, in such situation that some of the recovered plural containers have some amount of undried liquid beverage residue at the bottom and others have some amount of dried beverage matter at the bottom, the present invention can be so constituted that two colors or more are selected and any preferable range of areas occupied by these colors is decided beforehand and the recovered bottles are judged to be those recovered without being used for other purposes where they agree to any one of conditions for the range of respective color areas.

According to the present invention, it is possible to discriminate the bottles recovered without being used for other purposes from those utilized for other purposes with a sufficient precision. Further, the bottles can be washed with a good efficiency.
1. A method for discriminating recovered beverage containers which comprises the steps of:
selecting any particular color according to the color of the beverage contained in the container,
measuring the area of the selected color in the container,
determining whether the measured area of the color is within the fixed range or not, and discriminating the beverage containers in accordance with the determined result.

2. A method for discriminating recovered containers according to claim 1 wherein measuring the area of the selected color is made by counting the number of pixels in a picture taken by a camera unit detecting the selected color.

3. A method for discriminating recovered containers according to claim 1 or 2 wherein a fixed amount of water is supplied into the container before measuring the area of the selected color.
FIG. 4

FIG. 5
INTERNATIONAL SEARCH REPORT

International Application No. PCT/JP 90/00059

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 08 B 9/46

II. FIELDS SEARCHED

Classification System | Classification Symbols
--- | ---
IPC5 | B 08 B; B 07 C; G 01 N

Minimum Documentation Searched

Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched

III. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of Document, with Indication, where appropriate, of the relevant passages</th>
<th>Relevant to Claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>WO, A1, 88/00862 (THE COCA-COLA COMPANY), 11 February 1988, see page 13 - page 14; page 11, line 1 - line 9; abstract</td>
<td>1, 3</td>
</tr>
<tr>
<td>A</td>
<td>US, A, 4666635 (MIYAZAWA ET AL) 19 August 1986, see abstract; figures 1-6</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>US, A, 4368980 (ALRED ET AL) 18 January 1983, see the whole document</td>
<td>1-3</td>
</tr>
<tr>
<td>A</td>
<td>US, A, 4428674 (GIEBEL ET AL) 31 January 1984, see the whole document</td>
<td>1-3</td>
</tr>
</tbody>
</table>

**Category:** A Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "Z" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search
19th April 1990

Date of Mailing of this International Search Report
21st April 1990

International Searching Authority
EUROPEAN PATENT OFFICE

Signature of Authorized Officer

Form PCT/ISA/2/10 (second sheet) (January 1988)
This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EIP file on 28/02/90. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family members</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>WO-A1- 88/00862</td>
<td>11/02/88</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>US-A- 4606635</td>
<td>19/08/86</td>
<td>AU-B- 565157</td>
<td>03/09/87</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU-D- 3812585</td>
<td>08/08/85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP-A- 60159637</td>
<td>21/08/85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE-A- 3023211</td>
<td>22/01/81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GB-A-B- 2053466</td>
<td>04/02/81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP-A- 56008529</td>
<td>28/01/81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE-A- 3028942</td>
<td>18/02/82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FR-A-B- 2487981</td>
<td>05/02/82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GB-A-B- 2080946</td>
<td>10/02/82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP-A- 57118146</td>
<td>22/07/82</td>
</tr>
</tbody>
</table>

For more details about this annex: see Official Journal of the European Patent Office, No. 12/82.